Space Weather Technical Forecast

Issued on Tuesday, 08 February 2022 at 00:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor Storm activity days 2 and 3 (9th and 10th), associated with anticipated 6th Feb CME passagel. Active electron fluence expected days 1 and 2 (8th and 9th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with occasional C-class X-ray flares observed at GOES 16. These were mainly from AR2939 in the southwest quadrant, however the largest flare (C3 at 07/1239 UTC) was from an ex-region around the northwest limb (ex-2936 or ex-2938).

There are currently four sunspot regions on the visible disc. AR2939, in the southwest quadrant, is a bi-polar group with moderate magnetic complexity, and contains a large symmetric spot with small intermediate spots. AR2940 and AR2941, respectively located in the northwest and northeast quadrants, are both wide bi-polar groups, but have been mostly inactive, with an isolated small C-class flare from AR2941 this (7th) UTC morning. AR2942 is a small bi-polar group approaching the southwest limb.

No Earth directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1 by DSCOVR, has slowly decreased from 530 km/s to around 450 km/s. The density has also shown a similar trend, initially slightly above average, before falling to average. The total magnetic field has been weak, with the north-south component ranging +/- 3 nT. The phi angle was in negative (towards the Sun) orientation throughout. Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) measured at GOES 16 was at background levels. The high energy electron flux has been at High levels throughout, peaking at 6350pfu at 07/1720UTC. Electron fluence values are above the Active threshold and have shown a steady increase, reaching 3.44e8 integrated pfu at 08/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Low in the period, with further occasional C-class flares expected, and a chance of isolated M-class. These most likely from AR2939, AR2940 or AR2941, which are likely to remain present on the Earth-facing disc throughout the four days.

Solar Wind / Geomagnetic Activity: Waning coronal hole high speed stream effects are expected for day 1 (8th) and the first half of day 2 (9th), with geomagnetic activity expected to be mostly Quiet. The 6th Feb CME is then anticipated to arrive around midday or later on day 2 (9th), bringing an increase in geomagnetic activity and a likelihood of G1/Minor Storm activity. Day 3 (10th) is likely to see further CME influence with Unsettled to G1/Minor Storm activity,

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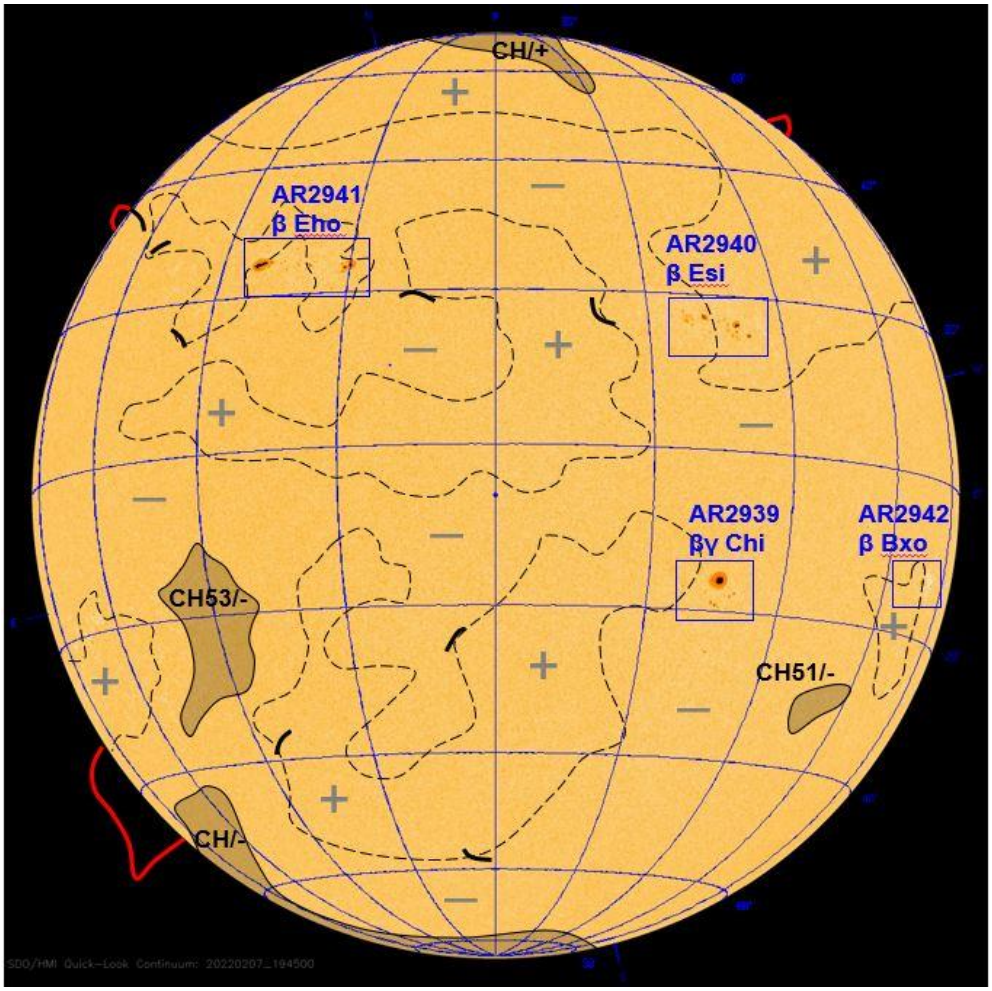
although this should begin to reduce later. By day 4 (11th) geomagnetic activity is expected to become Quiet, occasionally Unsettled, as any initial lingering CME effects die away.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is forecast to be at background levels, but with a slight chance of rising close to, or just above, the S1 level given any significant M-class flaring. High energy electron flux (greater than 2MeV) is expected to continue at mainly high levels until the arrival of 6th Feb CME on day 2 (9th), with Active (1e8 integrated pfu) fluence also expected to continue until this time. Thereafter, confidence becomes low, however it is currently assessed as more likely that Fluence will drop below the Active threshold for days 3 and 4 (10th and 11th), rather than remain above.

Figure 1. Solar Analysis Valid 07/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Met Office Space Weather Technical Forecast

Geomagnetic Storms:

Waning coronal hole high speed stream effects are expected for day 1 (8th) and the first half of day 2 (9th), with geomagnetic activity expected to be mostly Quiet. The 6th Feb CME is then anticipated to arrive around midday or later on day 2 (9th), bringing an increase in geomagnetic activity and a likelihood of G1/Minor Storm activity. Day 3 (10th) is likely to see further CME influence with Unsettled to G1/Minor Storm activity, although this should begin to reduce later. By day 4 (11th) geomagnetic activity is expected to become Quiet, occasionally Unsettled, as any initial lingering CME effects die away.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	60	40	10
Strong	G3	No	1	5	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
07/0003	Partial	Filament eruption near AR2939	Centre disc	408	09/1000 UTC	G1/Minor storm activity likely.

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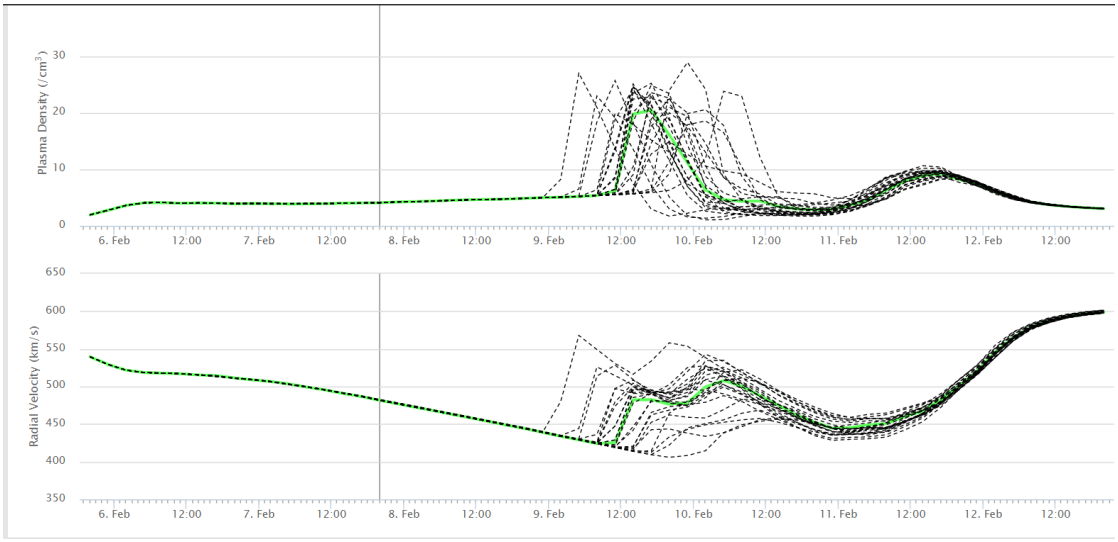
Figure 2: MOSWOC Enlil ensemble showing arrival time estimates for 6th Feb CME filament eruption.



Radio Blackouts - X-Ray Flares:

Solar activity has been Low in the past 24 hours, with occasional C-class flares. These were mainly from AR2939 in the southwest quadrant, however the largest flare (C3 at 07/1239 UTC) was from an ex-region around the northwest limb (ex-2936 or ex-2938).
There are currently four sunspot regions on the visible disc. AR2939, in the southwest quadrant, is a bi-polar group with moderate magnetic complexity, and contains a large symmetric spot with small intermediate spots. AR2940 and AR2941, respectively located in the northwest and northeast quadrants, are both wide bi-polar groups, but have been mostly inactive, with an isolated small C-class flare from AR2941 this (7th) UTC morning. AR2942 is a small bi-polar group approaching the southwest limb.

No significant returning regions are due in the period, and no newly-developed regions are evident on current STEREO A EUVI195 imagery. Meanwhile, AR2942 will transit around the southwest limb in the next couple of days.
Solar activity is expected to continue Low in the forecast period, with a chance (perhaps decreasing) of an isolated M-class flare.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	25	25	25	25
Very Active	R3 to R5 X Class	No	2	2	2	2

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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux, as measured by GOES-16 is at background levels. Solar radiation storms are not expected in the period. However, there is a very slight chance for proton fluxes to rise given any significant flaring from AR2939 and AR2940, as they continue to transit across the western hemisphere.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High energy electron flux (greater than 2MeV) has remained at High levels, peak 6.35e3 pfu at 07/1720 UTC, and is expected to continue at mainly high levels until the arrival of 6th Feb CME on day 2 (9th). The CME is likely to significantly redistribute electrons when it arrives, with the current Active fluence likely to continue until this time. Thereafter, confidence becomes low, with the forecast dependant on subsequent CME effects. It is currently assessed as more likely that Fluence will drop below the Active threshold for days 3 and 4 (10th and 11th), rather than remain above. There are no further persistent features to re-elevate electron flux counts in the period, although a degree of recovery is possible before the UTC weekend.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	99	90	40	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	5	5	1	1

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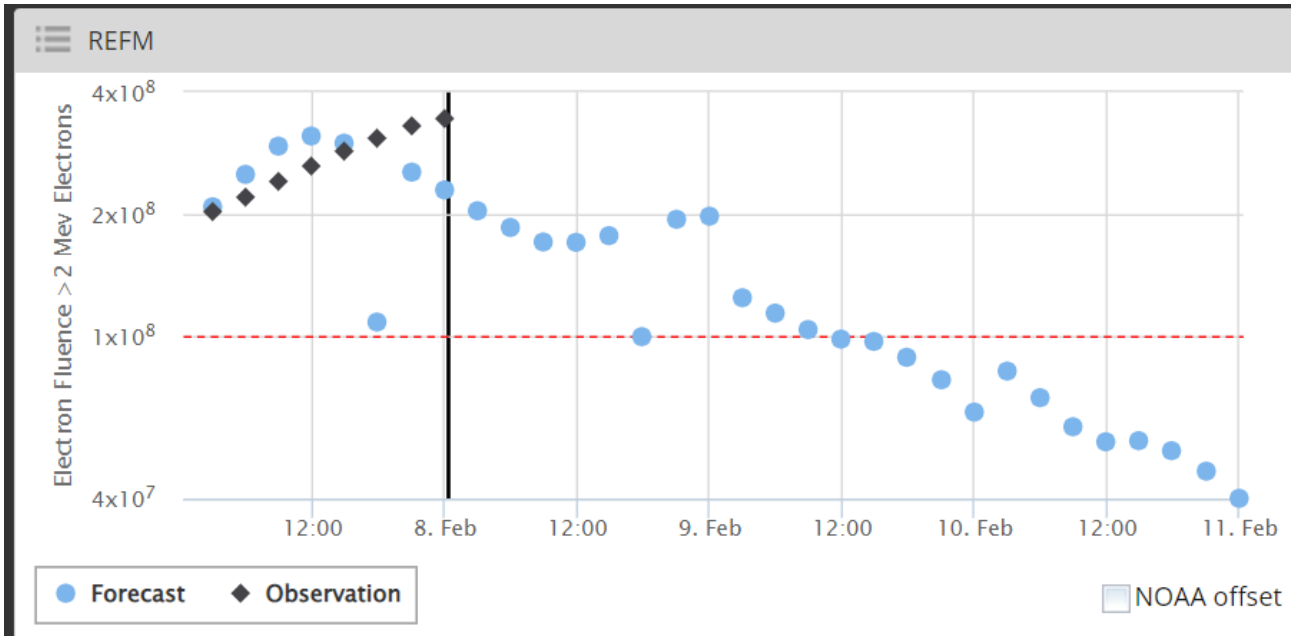
Figure 3: Latest MOSWOC REFM.



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